The Persistent and the Transitory in Corporate Leverage Ratios

Gayané Hovakimian*

Armen Hovakimian**

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ABSTRACT

We investigate the dynamics of observed and target leverage ratios and deviations from the targets. The cross-sectional persistence in observed leverage ratios is driven by highly persistent targets, whereas the time series variation is driven by transitory deviations from targets. Deviations are less persistent for firms that are overlevered and firms that are smaller, younger, focused, or have lower credit ratings. In recessions, excess leverage is less persistent for larger firms and is more persistent for smaller firms. Thus, consistent with dynamic trade-off theories, persistence is higher when the costs of deviating from targets are likely to be lower and when the costs of adjustment are likely to be higher.

* Gabelli School of Business, Fordham University, email: hovakimian@fordham.edu.
** Zicklin School of Business, Box B10-225, Baruch College, New York, NY 10010. Tel: (646) 312-3490; fax: (646) 312-3451; e-mail: armen.hovakimian@baruch.cuny.edu.

1. Introduction

A fundamental question in corporate finance is how corporate leverage ratios evolve and to what extent and how this process is driven by corporate leverage targeting behavior. Dynamic tradeoff models of capital structure suggest that corporate leverage ratios contain relatively stable targets but tolerate relatively transitory deviations from these targets, as long the deviations are within the target zone. This behavior affects the dynamics of leverage ratios over time and the variation in the leverage dynamics across firms. In this study, we investigate leverage dynamics by separating and assessing the persistence of its elements – the target leverage ratio and the deviation from the target.

Several empirical studies have addressed the issue of variations in leverage ratios but reached somewhat conflicting conclusions. Lemmon, Roberts, and Zender (2008) document significant persistence in leverage ratios over time. Using portfolios of firms sorted on leverage ratios, they show that leverage cross-sections are relatively stable over time horizons of up to twenty years and conclude that time-invariant firm-specific factors are the primary determinants of corporate capital structure policies. In contrast, DeAngelo and Roll (2015) document substantial variation in firm-level leverage ratios. They further find that while leverage cross-sections are relatively stable in the short- to medium-run, the differences grow over time, and that leverage cross-sections separated by long periods of time are very different.

The persistence documented in these studies could be driven by firms setting stable capital structure targets or relatively narrow target zones, which would be consistent with the tradeoff theory. Alternatively, it could be caused by enduring deviations from capital structure targets, which would indicate that target capital structures are not very important. Some level of persistence would also be consistent with Miller's (1977) neutral-mutation view, which suggests that firms have no targets and leverage ratios evolve randomly but slowly over time.

Likewise, the variability of leverage documented by DeAngelo and Roll (2015) could be driven by the possibility that firms either have constantly changing capital structure targets or do not set such targets at all. Alternatively, they could be driven by deviations from desired leverage targets that are very transitory for firms that have high tolerance for deviations and, hence, set relatively wide target zones.

To shed light on these issues, DeAngelo and Roll (2015) conduct simulations and compare the persistence levels they observe for the cross-sections of actual and simulated leverage over time. They conclude that models with targets that vary substantially over time, models with relatively wide target zones, and models with relatively low speeds of adjustment to stationary targets perform the best in terms of replicating the "term structure" of persistence in cross-sections of corporate debt ratios.

More direct evidence on these issues is offered by studies that rely on partial adjustment models (PAMs) as their primary empirical tool. Some of these studies generate low estimates of the speed of adjustment (SOA) to target that fit well with the conclusions in DeAngelo and Roll (2015).[1] However, other studies have produced much higher SOA estimates.[2] Furthermore, PAMs raise a number of methodological and interpretation issues. Specifically, PAMs estimated as dynamic panel regressions can produce inconsistent estimates (Flannery and Rangan (2006)), and PAMs that utilize in-sample estimates of targets suffer from look-ahead bias that overestimates the SOA (Hovakimian and Li (2011)). Furthermore, SOA estimates are meaningful only if: (1) firms

[1] Kayhan and Titman (2007), for example, estimate that the average firm offsets about 35-40 percent of deviation from target in five years.

[2] Flannery and Rangan (2006), for example, find that the average firm offsets about 35 percent of deviation from target in one year.

gradually adjust to targets following relatively large random shocks, or (2) firms allow their leverage ratios to fluctuate randomly within a certain zone and adjust fully to target when they hit the range boundaries. Empirical evidence suggests that even if firms have target levels and zones for debt ratios, they frequently engage in financial transactions when they are not close to the boundaries. These transactions frequently move them away from or "across" the estimated targets. Under such behavior, speed-of-adjustment estimates generated by PAMs are not economically meaningful descriptors of leverage dynamics (Hovakimian and Li (2012)).

To explore the dynamics underlying capital structure variations, we employ an alternative approach. We separate corporate leverage ratios into two components—target leverage and deviation from target leverage, and separately estimate their levels of persistence, along with that of observed leverage. Our goal is to explain the underlying contribution of each component's dynamics to the overall time-series and cross-sectional variation in leverage ratios.

If the persistence in leverage is caused by firms setting relatively stable capital structure target levels within relatively stable target zones, then the deviations from the target should be less persistent than the observed leverage ratios, which in turn should be less persistent than the targets. Furthermore, the levels of persistence of deviations from target would decline with the intensity of corporate financing behavior that tends to offset the deviations from target. If, on the other hand, the persistence in leverage is caused by enduring deviations from capital structure targets or if there are no targets and leverage neutrally mutates over time, then the persistence in deviations from estimated but not true targets should be similar to the persistence in observed leverage ratios.

We start by estimating target debt ratios using five-year rolling fixed effects regressions of observed debt ratios on a set of traditional determinants of target leverage. The coefficients estimated over the previous five years, *t-1* through *t-5,* along with firm characteristics in year *t* are then used to generate an estimate of target debt ratio for year *t*, i.e., our target estimates are based on out of sample predictions.

Our results indicate that the cross-sectional persistence in observed leverage ratios is likely due to persistence in leverage targets, whereas the time series variation in observed leverage is likely to be largely driven by transitory deviations from target leverage. In particular, consistent with Lemmon et al. (2008) and DeAngelo and Roll (2015), firms in our sample exhibit substantial persistence in leverage. For example, the R^2 from a regression of leverage on its 3-year lag is 0.51. We further find that our estimated target debt ratios are even more persistent and explain a significant portion of the cross-sectional variation in observed leverage ratios. For comparison, the R^2 from a regression of target leverage on its 3-year lag is 0.776. In contrast, deviations from target leverage are significantly less persistent with the R^2 from a regression of deviation from target leverage on its 3-year lag equal to 0.003 and are responsible for most of the time-series variation in leverage ratios.

To ensure that these results are not spurious, we randomly reassign each firm's time-series of estimated target debt ratios to another firm with the same number of time-series observations and re-estimate the persistence of the deviations from these simulated "targets". As expected, the persistence of deviations from randomized targets is very high, with the R^2 from a regression of deviation from randomized target leverage on its 3-year lag equal to 0.61.

We further examine a number of variations in the persistence of deviations. We find that the persistence is significantly related to the signs and magnitudes of deviations. Specifically, negative deviations from target, or leverage deficits, are significantly more persistent than positive deviations, or excess leverage, suggesting that the costs of deviating from target are higher for over-levered firms. We also find that larger deviations from target are even less persistent, consistent with the notion that the costs of deviating from the target increase with the size of the deviation and at some point trigger adjustments. In addition, deviations in years with corporate financing transactions are less persistent than in years without such transactions, which is what we would expect if financing transactions are used to offset deviations from target.

Further, we hypothesize that leverage target and deviation dynamics may vary across different types of firms and across different time periods. In particular, deviations are more likely to endure when the costs of adjustments outweigh the costs of being under-levered or over-levered. Since most leverage adjustments require some sort of financing and often involve security issues, the costs of adjustment are expected to vary depending on firms' capacity to access external capital markets. As a result, other things equal, firms that are financially constrained will face higher costs of capital structure adjustments and, consequently, take longer to offset deviations from their desired target levels of leverage. These differences may become more apparent during time periods when external capital markets are tighter due to a recession or a monetary contraction.

Deviations are also more likely to endure for firms whose values as a function of leverage are relatively flat, i.e., those with lower costs of excessively high or low leverage. Other things equal, firms with lower costs of excessively high or low leverage will be more willing to tolerate larger deviations from their leverage targets and, consequently, take longer to offset deviations from these targets.

We find that the level of persistence varies with firm size, age, diversification status, and credit ratings. Specifically, smaller firms, younger firms, single-segment firms, and firms with low credit ratings tend to show less persistence in their deviations from that target. These patterns are not consistent with the hypothesis that variations in leverage persistence are driven by variations in costs of adjustment to target leverage but imply that firms are less likely to offset their deviations from target when the cost of deviating is lower.

Our paper contributes to the existing literature in a number of ways. It complements the analysis of Lemmon et al. (2008) and DeAngelo and Roll (2015) by highlighting how the observed dynamics of leverage ratios can be generated by two components – a very persistent target and a transitory deviation. Furthermore, the straightforward methodological extension of DeAngelo and Roll's (2015) approach to examine the persistence of deviations from target leverage presents itself as a more robust alternative to standard partial adjustment framework used in prior studies to analyze leverage dynamics. In addition, our finding that persistence of deviations from target is virtually zero for an average firm at three-year horizon is among the strongest empirical findings in favor of dynamic tradeoff theories in the literature.

The paper also examines two issues regarding target debt ratios that have been raised in recent literature. First, we compare time-invariant and time-varying target debt ratios and find that time-varying targets explain observed debt ratios better than time-invariant targets. We also find that the deviations from time-invariant targets are more persistent than the deviations from time-varying targets. These results are especially true in the subsample of firms with long time-series and when targets (both time-invariant and time-varying) are generated out of sample. Overall, these results support the notion of time-varying as opposed to time-invariant target.

The second issue is that although a fairly standard set of firm characteristics affects capital structure in ways consistent with the predictions of the tradeoff theory, the importance of these factors in explaining the cross-sectional and time-series variations in leverage is limited (Lemmon, Roberts, and Zender (2008), DeAngelo and Roll (2015)), especially in comparison with the importance of fixed firm effects. This led prior literature to conclude that the most important determinants of target debt ratios remain unobservable to researchers. To shed additional light on this issue, we examine how traditional firm characteristics explain the cross-sectional and the time series variations in the rolling fixed effects component of our time-varying targets. We find that, in the last twenty years of our sample period, on average twenty percent of cross-sectional variation in the rolling fixed effects component is due to variation in traditional firm characteristics. In the time-series, traditional firm characteristics explain on average ninety-five percent of the variation in the rolling fixed effects component. These results suggest that firm characteristics are not as unimportant as they may appear in fixed effects regressions, though individual firm-level coefficient estimates for firm characteristics vary widely in time-series regressions, raising new questions about their traditional interpretations.

The paper proceeds as follows. Section 2 describes the sample. Section 3 describes the estimation of the target and presents the target estimation results. Section 4 examines the persistence of leverage, target leverage, and deviations from target leverage. Section 5 compares the performance of time-invariant and time-varying target estimates. Section 6 presents the results of falsification tests that validate our interpretations. Section 7 examines the variation in persistence by the size and direction of deviation from target and by the presence of corporate financing activities. Section 8 examines the cross-sectional variation in persistence by firm size, age, diversification status, and credit rating. Section 9 discusses persistence and corporate dynamic tradeoff behavior and compares persistence regressions and partial adjustment models. Section 10 examines the role of firm characteristics in cross-sectional and time-series variation in target leverage. Section 11 presents our conclusions.

2. Sample and variables

We construct the initial sample by drawing all firms that have record in Compustat between 1966 and 2015. We exclude firms in financial services industries (SIC codes 6000 through 6999) and firms with values of total assets or sales of less than $1 million. We retain only observations with non-missing values of variables of interest from Compustat. All ratio variables, except leverage, are trimmed at top 1% of the sample distribution. Ratio variables that take on negative values are also trimmed at bottom 1% of the sample distribution. Leverage is trimmed from above at the value of one. Since we use five years of data to estimate target leverage, the data from 1966-1970 are only used in estimating leverage targets for 1971-1975 and the final sample used in our analyses actually spans the period between 1971 and 2015. Our final sample includes 125,536 firm-years. Table 1 reports the descriptive statistics for firm characteristics that have been used in prior studies as determinants of target leverage.

3. Separation of leverage ratios into *target* and *deviation from target* components

Our empirical analysis proceeds in several steps. In the first stage, we separate observed leverage ratios (Lev_{it}) into *target leverage* (Lev_{it}^{*}) and *deviation from target* (Dev_{it}) components. To do that, first, we estimate five-year rolling leverage regressions based on the following model and then use the parameter estimates to calculate out-of-sample leverage targets:

$$Lev_{it} = \beta_{0i} + \beta_1 \times Market\text{-}to\text{-}book_{it} + \beta_2 \times Tangibility_{it} + $$
$$+ \beta_3 \times RD_{it} + \beta_4 \times RDD_{it} + \beta_5 \times Exp_{it} + \beta_6 \times Size_{it} + \varepsilon_{it}. \qquad (1)$$

In (1), for each firm i in year t, *Lev* is calculated as the sum of short-term and long-term debt divided by the book value of assets. *Market-to-book* is the ratio of market value of assets over book value of assets, *Tangibility* is the ratio of fixed capital over total assets, *RD* is the ratio of

R&D expenses over sales, *Exp* is the ratio of selling and administrative expenses over sales, and *Size* is the natural log of CPI-adjusted sales.[3] Since many firms without *R&D* do not report *R&D* at all, we replace missing values of *R&D* with zeroes and include an indicator variable, *RDD*, for such observations in regression (1) and following tests.

The explanatory variables are borrowed from Hovakimian, Opler, and Titman (2001) and are proxy variables for the determinants of optimal capital structure outlined by the trade-off theory. Specifically, firms with high growth opportunities (high market-to-book) are expected to have low target leverage ratios to avoid debt overhang (Myers, 1977). Firms with high tangibility are likely to have relatively low bankruptcy costs due to the collateral value of tangible assets and, therefore, high target debt ratios (Titman and Wessels, 1988). Firms with unique assets and products (high R&D expenses and high selling expenses) are likely to have high costs of financial distress and, therefore, low leverage targets (Titman, 1984).[4] Large firms may have high leverage targets because they tend to have less volatile cash flows and are less likely to become financially distressed (Rajan and Zingales, 1995). We estimate regression model (1) with fixed firm effects (β_{oi}) to account for omitted time-invariant determinants of target leverage.

For each firm-year, Lev_{it}^* is calculated as an out-of-sample predicted value based on the parameter estimates obtained from regression (1), estimated over the previous five years, *t-1* through *t-5*.[5] Figure 1 illustrates the timing convention that we follow. The rolling five-year regression approach allows us to incorporate fixed firm effects that vary over time, something that

[3] Market value of assets is (total assets – book equity + market equity). Book equity is the book value of stockholders' equity, plus balance sheet deferred taxes and investment tax credit (TXDITC), if available, minus the book value of preferred stock. To estimate the book value of preferred stock, we use the redemption (PSTKRV), liquidation (PSTKL), or par value (PSTK), in that order, depending on availability. Stockholders' equity is (SEQ), if it is available. If not, we measure stockholders' equity as the book value of common equity (CEQ) plus the par value of preferred stock, or the book value of assets minus total liabilities (LT).

[4] R&D has also been used as a proxy for growth opportunities.

[5] For each Lev_{it}^*, we require a minimum of two observations per firm during the applicable estimation period.

was found to be important in DeAngelo and Roll (2015). Predicting target leverage out of sample gives us more confidence that any evidence of importance of target leverage in subsequent tests reflects the underlying economics of firm behavior rather than the mechanics of target estimation. Using the estimated Lev_{it}^{*}, we calculate deviations from target leverage for each firm-year as:

$$Dev_{it} = Lev_{it} - Lev_{it}^{*}. \tag{2}$$

Based on (2), firms with positive deviations are considered over-levered and those with negative values are considered under-levered. Since we use a five-year estimation period prior to each Lev_{it}^{*}, and our data start in 1966, the first sets of targets and deviations are estimated for year 1971, and the last ones are estimated for year 2015. Table 2 presents the summary statistics for estimated targets of leverage and deviations from estimated targets. As expected with regression-based estimates, the mean target leverage ratios are not substantially different from observed leverage ratios.[6] The medians of target and observed leverage ratios are also close, and the mean and median deviations are close to zero. Figure 2 presents a histogram of deviations from target leverage. Most of the deviations are relatively small and ninety percent of the sample deviations are between -0.17 and 0.20.

4. Persistence of deviations from target leverage

If firms have target leverage ratios and if we are sufficiently successful in generating good estimates for these targets, then firms should tend to offset their accumulated deviations and the deviations should not persist for long periods of time. In this section, we test this standard

[6] Had the targets been estimated using a single regression on a full sample, the mean deviation from target would be exactly zero. Given that we estimate the targets using rolling five-year regressions and predict the targets out of estimation sample, the mean deviations are not exactly zero but are economically trivial.

prediction of the tradeoff theory by using simple tests of persistence of deviations from the target. Specifically, similar to DeAngelo and Roll (2015), we measure the persistence of deviations from leverage targets using a regression model between a current level and a lagged level of Dev_{it}, starting with the first lag and moving backward for n lags, one year at a time:

$$Dev_{it} = \beta_0 + \beta_1 \times Dev_{it-n} + \varepsilon_{it}. \quad (3)$$

We estimate (3) n times, one for each of the n consecutively lagged values of Dev_{it}. Estimates of β_1 reflect the statistical significance, as well as the economic magnitude of persistence in estimated deviations. The R^2s reflect the extent to which the cross-sectional variation in deviations from targets in year t is explained by the cross-sectional variation of deviations in year t-n. Note also that because the standard deviations of Dev_{it} and its lags are similar in magnitude, the β_1 coefficient estimates are roughly equal to the correlations between Dev_{it} and its lags. The results of the estimation are presented in Table 3.

The results in Table 3 show that the deviations from target leverage are much less enduring than the leverage ratios, which were studied in Lemmon et al. (2008) and DeAngelo and Roll (2015). Specifically, the coefficient on the first lag is 0.600, declines by more than fifty percent to 0.297 on the second lag and becomes economically trivial at 0.058 on the third lag. Likewise, the R^2, which is 0.330 with the first lag, drastically declines to 0.078 with the second lag and becomes 0.003 with the third lag. These results are consistent with the dynamic models of capital structure suggesting that firms offset deviations from target leverage within an economically short time frame.

It is important to check whether the finding of low persistence in deviations from target is due to unusually low persistence of leverage ratios or leverage targets in our sample. To measure the persistence of leverage, we use a similar regression model between a current level and a lagged level of Lev_{it}:

$$Lev_{it} = \beta_0 + \beta_1 \times Lev_{it-n} + \varepsilon_{it}. \tag{4}$$

Unlike the results in Table 3, the results presented in Table 4 show significant tenacity of observed leverage. Specifically, the persistence in leverage ratios declines gradually, as we increase the distance between current and lagged values of leverage, but stays both economically and statistically highly significant after three years. The coefficient estimate for the first lag is 0.897 and declines to 0.740 for the third lag, and the R^2 is 0.768 for the first lag and declines to R^2 of 0.510 for the third lag. Such a degree of persistence is consistent with the findings of DeAngelo and Roll (2015).

To measure the persistence of leverage targets, we use a similar regression model between a current level and a lagged level of Lev_{it}*:

$$Lev_{it}^{*} = \beta_0 + \beta_1 \times Lev_{it-n}^{*} + \varepsilon_{it}. \tag{5}$$

The results presented in Table 5 show that the persistence for target leverage is even stronger than the persistence of observed leverage. Specifically, the coefficient of the first lag is close to one at 0.975 and declines to 0.879 for the third lag. Because the leverage targets are estimated using five-year rolling regressions, targets that are five years apart are estimated using completely different five-year subsamples and could, in principle, be very different. To see whether that is the case, Table 5 presents persistence regressions using the fourth and the fifth lags as well. The results show that even at the fifth lag, there is substantial persistence in target with a coefficient estimate of 0.754 and an R^2 at 0.568.

To illustrate the similarity and the differences between our findings and the findings in the two important precursor studies, we summarize our results in two figures. Figure 3 is similar to Figure 1A in Lemmon, Roberts, and Zender (2008). Here, every year, we sort all firms into four portfolios based on their leverage ratios and then track the average leverage ratios of these portfolios over time. This is presented in Figure 3A. Similarly, we sort firms into four portfolios based on their deviations from target leverage ratios and track the average deviations from target of these portfolios over time. This is presented in Figure 3B. Consistent with Lemmon, Roberts, and Zender (2008), the cross-section of leverage ratios is very persistent over time. In contrast, deviations from target leverage ratios are not persistent and the differences between portfolio deviations disappear after 2-3 years.

Figure 4 is similar to Figure 3B in DeAngelo and Roll (2015). Here, we estimate regressions of leverage ratios in year t on leverage ratios in year t-n and plot the R^2 as a function of the n years separating the leverage ratios. This is represented by the upper graph in Figure 4. Similarly, we estimate regressions of deviations from target leverage ratios in year t on deviations from targets in year t-n and plot the R^2 as a function of the n years separating these ratios. This is represented by the lower graph in Figure 4. Consistent with DeAngelo and Roll (2015), the R^2's of leverage ratio regressions start with a high number (0.768) and then slowly but steadily decline with the number of years separating the leverage cross-sections. In contrast, the R^2's of deviations from target leverage ratios start at the much lower level of 0.330 and quickly decline to effectively 0 by year 3.

Overall, the results in this section imply that leverage targets are relatively stable but change slowly over time, and deviations from targets are transitory and are offset within two to three years, an economically short period of time. These findings suggest that the cross-sectional persistence in observed leverage ratios is likely due to persistence in leverage targets, whereas the time series variation in observed leverage is likely to be largely driven by transitory deviations from target leverage.

5. Time-Invariant vs. Time-Varying Targets

One way to compare the performance of time-varying vs. time-invariant targets is to assess how much of the variation in observed leverage ratios is explained by these targets. Hence, we estimate a pooled OLS regression of observed leverage ratios on our rolling target estimates and report the results in column (1) of Table 6, Panel A. At 0.654, the R^2 can be considered fairly high, which supports the notion that firms tend to set targets for their leverage and suggests that these could be reasonable estimates of the actual targets. For comparison, column (2) reports the results for a similar regression on targets obtained by estimating model (1) as a single fixed-firm-effects regression on the full sample, as opposed to five year rolling regressions. The R^2 of 0.659 is almost identical to that in column (1).

At first glance, the similarity of the R^2s in columns (1) and (2) may appear to contradict DeAngelo and Roll (2015), who argue that allowing firm fixed effects to change over time is important. The target leverage in column (1) is estimated using rolling five-year regressions and, hence, allows for firm effects to be fixed over each five-year estimation period but to vary across different five-year periods. In the regression presented in column (2), firm effects are fixed over the whole sample period. The sample in these regressions, however, is dominated by firms with relatively short time-series. Allowing firm effects to change across different five-year periods does not make much difference for such firms.

To highlight the difference between firm effects that are fixed over rolling five-year periods and those that are fixed over the entire sample period, we repeat the analysis on the subsample of firms with at least 20 years in their time-series and report the results in Panel B. The R^2 of 0.654 for the rolling target model in column (1) of Panel B is identical to the R^2 from the corresponding regression in Panel A. More importantly, however, the R^2 of 0.507 for the fixed firm effects regression in column (2) of Panel B is now substantially lower compared to the R^2 of 0.654 for the corresponding regression in Panel A. This is consistent with DeAngelo and Roll (2015), as it indicates that allowing firm fixed effects to change over time helps improve their explanatory power.

In full-sample fixed effects regressions reported in columns (2) of Panels A and B, the target leverage is estimated in-sample, using all observations in the sample firms' time-series. For a more adequate comparison, we use the initial rolling out-of-sample target leverage estimate for the first year of each firm's time-series and keep it constant for all years. Thus, for each firm, the time-varying and the time-invariant targets are the same in the first year of the time-series, but the time-invariant target remains constant, whereas the time-varying one changes as rolling 5-year regressions generate new estimates for every year.

Columns (3) in Panels A and B report the results of regressions of leverage on the time-invariant out-of-sample initial target. Panel A reports the results for the full sample. The results show that the R^2 from the time-invariant initial target is 0.280, which is substantially lower than the R^2 of 0.654 obtained from the time-varying target in column (1). Panel B reports the results for

20-year survivors only. Once again, the R^2 from the time-invariant initial target is 0.151, which is much lower than the R^2 of 0.654 obtained from the time-varying target in column (1).

The comparison of the time-invariant and time-varying targets based on how well they explain observed leverage ratios comes with an important caveat: It is not necessarily true that the better estimated target will generate higher R^2 in regressions of observed leverage on target leverage. As represented by equation (2), observed leverage can be thought of as a sum of target leverage and deviation from target. If deviations from targets are random with respect to firm characteristics, then firm characteristics and fixed effects will explain only the targets, and higher R^2's will imply better estimated targets. However, if deviations are not random but are related to firm characteristics, then higher R^2's will be associated with worse target estimates. This is possible if, for example, shocks to leverage or costs of adjusting leverage to target, hence the magnitudes of corresponding deviations, are related to firm characteristics.

As an alternative way to compare the performance of time-varying and time-invariant targets, we estimate the persistence of deviations from the time-invariant initial target at one-, two-, and three-year horizons. The results presented in Table 7 show that the deviations from such a time-invariant target are much more persistent than the deviations from time-varying targets. The R^2 for deviations that are 3 years apart is 0.495 with time-invariant targets, compared to 0.003 with time-varying targets in Table 3.

Overall, the results in this section results support the notion of time-varying as opposed to time-invariant target.

6. Falsification Tests

To rule out that the statistical properties of observed leverage ratios and the estimated targets could plausibly generate transitory deviations from target leverage without an underlying economic mechanism of leverage targeting, we carry out falsification tests. To conduct these tests, we simulate leverage targets by randomly reassigning the estimated firm-level sequences of Lev_{it}^* to other firms in our sample that have the same number of observations in their time-series. We then calculate new deviations from simulated leverage targets using the real observed leverage ratios and the simulated targets and re-estimate model (3) based on simulated deviations. If our prior results on persistence of deviations from target leverage are merely a statistical artifact that could arise with random targets that lack any economic meaning but have the statistical properties specific to our sample, then the random reassignment of targets should produce similar results.

In Table 8, we present our results on the persistence of simulated deviations, which reveal a picture that is very different from the one we observed with deviations based on the firms' own estimated targets. Specifically, instead of correlations between the consecutive lags of deviations that start at a low level and decline fast, we now observe very high and persistent correlations which exceed those found for both leverage ratios and estimated deviations. More precisely, the coefficient estimate on the three-year lag of simulated deviations is 0.795 and the R^2 is 0.609. For comparison, the coefficient estimate on the three-year lag of observed leverage ratios is 0.740 with an R^2 of 0.510 (Table 4), and the coefficient estimate the three-year lag of estimated deviations is 0.058 with an R^2 of 0.003 (Table 3). Thus, our main results on persistence of deviations from target reported in the previous section are unlikely to be spurious and are likely to reflect meaningful firm behavior.

7. Persistence of deviations by deviation characteristics

While our results in the previous sections indicate that deviations from target leverage are, on average, rather short-lived, there may be variations in how fast firms offset deviations depending on the specifics of deviations and firm characteristics. In particular, other things equal, leverage excess and leverage deficit may be treated differently. Likewise, deviations that are more significant in size may be treated differently compared to those that are relatively minor. In this section, we test if the persistence of deviations from estimated targets varies depending on whether deviations are positive or negative and whether deviations are large or small. In the following section, we conduct similar tests based on firm characteristics.

7.1 Positive vs. negative deviations

The persistence of positive and negative deviations from target can be expected to be different for two reasons. First, the marginal effect of debt on firm value around the target debt ratio may not be symmetrical. If, for example, one extra dollar of debt beyond *Lev** results in a significantly higher value loss than one less dollar below *Lev**, then, other things equal, over-levered firms may be more likely to offset their deviations from target than under-levered firms.

Second, reductions and increases in leverage require firms to undertake different types of corporate financing transactions, such as issuing equity versus issuing debt or repurchasing equity versus reducing debt. Depending on the required type of action, the costs of adjusting leverage up or down could be different. This could make firms more likely to undertake transactions in one direction than the other, which could lead to different levels of deviation persistence for over- and under-levered firms. When making decisions about offsetting deviations from target, firms are likely to weigh the costs of staying over-levered or under-levered against the costs of adjustment.

In Table 9, we re-estimate regression model (3) with an additional indicator for negative lagged deviations on the right hand side, along with an interaction term of that indicator with the lagged deviations. The results show that the interaction effects are positive and statistically significant at lags one and two and insignificant at lag three. This implies that deviations from target are somewhat more persistent for under-levered firms. The higher persistence of negative deviations indicates that firms are more willing to stay under-levered than over-levered, even though the costs of issuing debt are generally lower than the costs of issuing equity. This result suggests that the asymmetry in the treatment of positive versus negative deviations is likely to be driven by value losses that are higher from above-target leverage than from below-target leverage.

7.2 Large deviations

Dynamic tradeoff models of capital structure imply that firms have target debt zones within which they do not adjust to target. Leverage adjustments are triggered when the deviations from the targets cross the boundaries of these zones. Even though target boundaries are unobservable, firms are more likely to be crossing them when the estimated deviations are larger. Thus, other things equal, under the type of behavior predicted by tradeoff models, an adjustment to target would be more likely when the deviation is larger.

In Table 10, we re-estimate regression model (3), for subsamples of firms with large positive or large negative deviations. We consider a deviation as large if it is one sample standard deviation above or below zero. In all six specifications, the independent variable is the large deviation. Relative to the dependent variable, which is the current deviation, it is lagged by one period in models (1) and (4), two periods in models (2) and (5), and three periods in models (3) and (6). The R^2s of the regressions in Table 10 demonstrate that the persistence of large deviations, both positive and negative, is lower than the persistence of deviations observed for the full sample in Tables 3 and 9, which is consistent with the predictions of dynamic tradeoff models. This comparison understates the difference between the persistence of large and small deviations because the results in Tables 3 and 9 are not restricted to small deviations only.

Unlike the results presented in previous tables, the coefficient estimates on the lagged values and the R^2s in Table 10 are no longer equivalent. Because the lagged values are limited to being either large negative (columns (1) to (3)) or large positive (columns (4) to (6)), the standard deviations of lagged values are substantially smaller than the standard deviations of the dependent variable. Indeed, figures 5A to 5C show that distributions of large negative deviations (5A) change substantially one year (5B) and two years (5C) later. The figures demonstrate how a truncated distribution of large negative deviations (5A) becomes fairly symmetric and visually similar to the unconditional distribution of deviations two years down the road. Similar patterns are observed in figures 6A to 6C for large positive deviations.

In Table 11, we supplement the analysis in Table 10 by examining the average time-series dynamics of deviations from target three years before and three years after the large deviations are observed. Panel A presents the results for large negative deviations. Panel B presents the results for large positive deviations. In each panel, the first row shows the average deviations from target, and the second row shows the average differences between current-year deviations and year 0 deviations, with their statistical significance.

First, note that the average "large" deviation is fairly large. In year 0, the average large negative deviation is -0.195 and the average large positive deviation is 0.213. The comparison of the average values in the time series shows that, in each of the six years around year 0, the absolute deviations are significantly smaller than the deviations in year 0. This result holds for both large negative (Panel A) and large positive (Panel B) deviations. The deviations in year -3 relative to the year of a large deviation are close to zero, implying that large deviations build up over time. The average deviation in year +3 is economically trivial, consistent with the hypothesis that firms quickly offset large deviations from the target.

Finally, to test whether the decline in deviations is due to active rebalancing, we sort all firms into quartiles based on their deviations from the target and then examine the corporate financing activities the following year. The results presented in Table 12 show that compared to underlevered firms (quartile 1), overlevered firms (quartile 4) are significantly more likely to issue equity (10.4% vs. 7.8%) and retire debt (29.8% vs. 12.7%) and are significantly less likely to issue debt (24.6% vs. 29.6%) and repurchase equity (3.5% vs. 6%). All differences are statistically significant at the one percent level and are consistent with rebalancing toward the target.

The differences between the middle two portfolios (quartiles 2 and 3) are significantly smaller in magnitude than the differences between quartiles 1 and 4, consistent with the idea that active efforts to offset the deviations from target intensify when the deviations become large and leverage ratios fall outside the target zone.

7.3 Financing transactions

In this subsection, we examine the persistence of deviations from target debt ratios in years when firms undertake at least one of the following corporate financing transactions: equity issue, equity repurchase, debt issue, debt reduction. As we discussed earlier, fixed transaction costs may deter firms from adjusting to their leverage targets. However, for a firm undertaking a financing transaction, for example, to finance an investment project, the financing cost is largely sunk.[7] As a result, the marginal cost of choosing the type of financing that would allow the firm to offset its deviation from the target should be low.

In Table 13, we present the estimation results for regression model (3), separately for years with and without major corporate financing transactions. We follow the prior literature and define major transactions as debt or equity issuance or repurchase in excess of five percent of pre-transaction firm assets.[8] Consistent with our conjecture, the persistence of deviations from target

[7] Faulkender, Flannery, Hankins, and Smith (2012) make this point in their paper.
[8] Equity issues are defined as cases when net equity issued is greater than 5% of pre-repurchase assets, where net equity issued is measured as the sale of common stock and preferred stock (SSTK) minus the purchase of common

leverage is substantially lower in years with corporate financing transactions than in years without such transactions. Further, we observe a more significant decline in persistence for financing firms when they are over-levered. Specifically, among over-levered firms, the coefficient on the lagged deviation is 0.810 for firms with no major financing activities and is 0.519 for firms with financing activities. Among under-levered firms, these coefficients are 0.740 and 0.602, respectively.

8. Persistence of deviations by firm characteristics

In this section, we examine the cross-sectional variations in deviation persistence based on firm size, age, credit rating, and diversification status. We also examine deviation persistence during recession versus no recession periods. Dynamic tradeoff models imply that adjustments to target are more likely when the adjustment costs are lower. The criteria of sample separation described above reflect the degree of adjustment costs across firms, and the recession and non-recession periods reflect such differences across the business cycle. In particular, lager firms, more mature firms, diversified firms, and firms with higher ratings are likely to have lower adjustment costs because they have easier access to financing. Similarly, in non-recession periods, firms are likely to be less financially constrained and incur lower costs of adjustments than in recessions.

Dynamic tradeoff models also imply that firms with lower costs of excessively high or low leverage are less likely to adjust. Larger firms, more mature firms, diversified firms, and firms with higher ratings, as well as firms, in general, in non-recession periods, are likely to face lower costs of deviating from the target, especially when overlevered, as they are likely to have the financial flexibility to fund their investment projects and make leverage adjustments when needed.

stock and preferred stock (PRSTKC). Equity repurchases are cases when net equity issued is lower than -5% of pre-repurchase assets. Debt issues are defined as cases when net debt issued is greater than 5% of pre-repurchase assets, where net debt issued is measured as the change in the sum of long-term (DLTT) and short-term (DLC) debt. Debt repurchases are cases when net debt issued is lower than -5% of pre-repurchase assets.

Thus, there are two alternative possibilities with opposite predictions, depending on the significance of adjustment costs and the costs of deviating relative to each other. Given our earlier finding that the deviations are more persistent for under-levered firms than for over-levered firms, all the cross-sectional analyses are conducted for over- and under-levered firms separately.

8.1 Firm Size

In Table 14, we report the results of estimation of regression model (3) for firms sorted into size quartiles. Panel A reports the results for under-levered firms, with the smallest firms in column (1) and the largest firms in column (4). The results show similar persistence levels across the four size groups and no discernable pattern of change in the coefficients on lagged deviations or the R^2 of the regressions. For over-levered firms presented in Panel B in the same order, we observe that the smallest firms tend to have the least persistent deviations from the target. In addition, the persistence levels are higher for under-levered firms than for over-levered firms for all size groups, but the difference is the largest for firms in the smallest quartile. Overall, small over-levered firms have the least persistent deviations, despite higher expected adjustment costs. This implies that, for these firms, the expected costs of remaining over-levered are quite high and, in their consideration, outweigh the costs of adjustment.

One possible explanation for these results is that excess leverage may aggravate financial constraints, especially for smaller firms. For example, Covas and Den Haan (2011) report that corporate financing, both debt and equity, is procyclical, especially for smaller firms. This suggests that small firms might have difficulty adjusting their leverage in a downturn and hence might proactively prefer to no not allow any deviations to persist for long.

8.2 Age

In Table 15, we report the results of estimation of regression model (3) for firms sorted into age quartiles. Panel A reports the results for under-levered firms. The persistence of deviations, as reflected in the coefficient estimates for lagged deviation and R^2s, is the lowest for the youngest quartile. It is higher and similar across the three quartiles with older firms. Panel B reports the results for over-levered firms and, once again, the firms in the youngest quartile tend to have the least persistent deviations from the target. Consistent with our previous findings, the persistence levels for under-levered firms are higher than for over-levered firms for all age groups. Overall, younger firms have the least persistent deviations, especially when over-levered. The expected costs of excess leverage are likely to be higher for these firms for a number of reasons. Given their typically higher growth opportunities, younger firms may try to eliminate excess leverage more rigorously to avoid a potential debt overhang problem or a possible exacerbation of financial constraints that are likely to be more binding for them. Another factor possibly contributing to the low persistence of excess leverage at such firms is that, while raising external financing, and more likely equity, for their investment needs, the opportunity to offset excess leverage may come as a desired side result.

8.3 Diversification

In Table 16, we report the results of estimation of regression model (3) for firms classified based on their diversification status. Firms that have multiple business segments are classified as diversified. Columns (1) and (2) report the results for under- and over-levered single-segment focused firms, respectively. Columns (3) and (4) report the results for, respectively, under- and over-levered diversified firms. The results show that over-levered single-segment firms have the least persistent deviations (lower coefficient estimates on lagged deviation and R^2). This is likely because the expected costs of excess leverage are high for these firms, consistent with our prior findings for smaller and younger firms.

8.4 Credit rating

In Table 17, we report the results of estimation of regression model (3) for firms classified based on their credit rating into four groups: unrated firms, firms in significant danger of default (CCC+ and lower), speculative grade firms (B- through BB+), and investment grade firms (BBB- and higher). Panel A reports the results for under-levered firms. Panel B reports the results for over-levered firms. The lowest level of persistence is observed for firms in significant danger of default (CCC+ and lower), especially those classified as over-levered, who show zero persistence within one year. This is not surprising as these firms have the most urgent need to change their capital structure. Among other patterns observed, over-levered non-rated firms show less persistent deviations than those rated speculative (B- or higher) or investment (BBB- or higher) grade. This is likely because the expected costs of excess leverage are higher for unrated firm as they lack the financial flexibility of the investment grade and even speculative grade (B- and higher) firms.

8.5 Business cycle and firm size

In Table 18, we report the results of estimation of regression model (3) across recession and non-recession periods. We obtain the business cycles information from the National Bureau of Economic Research (NBER) *Business Cycle Expansions and Contractions*. During the period between 1980 and 2008 covered in the study, NBER identifies the following periods of economic recessions: January, 1980 – July, 1980; July, 1981 – November, 1982; July, 1990 – March, 1991; March, 2001 – November, 2001; December, 2007 – June, 2009. We define any fiscal year with at least one month that coincides with an NBER recession as a recession year.

Panel A reports the results for under-levered firms, with the smallest firms in columns (1) and (2) and the largest firms in columns (3) and (4). While there are slight variations in the coefficient estimates on lagged deviations and the R^2 of the regressions, the results for both large and small firms imply similar persistence levels across the business cycle. For over-levered firms presented in Panel B in the same order, we observe that the smallest firms tend to exhibit substantially more persistence in deviations from the target in recession years compared to non-recession years. In contrast, the largest firms tend to exhibit substantially less persistence in deviations from the target in recession years compared to non-recession years.

The finding that small over-levered firms have more persistent deviations in recessions whereas large over-levered firms have less persistence in recessions implies that financial constraints impede leverage adjustments for small firms whereas large firms enjoy financial flexibility that allows them to reduce their excess leverage in recessions when the costs of such excess leverage could be higher. This finding is consistent with Covas and Den Haan (2011), who find that equity issuance is more procyclical for smaller firms, but is countercyclical for very large firms.

9. Persistence and corporate dynamic tradeoff behavior

Regression model (3) that we used to estimate the persistence of the deviations from the target can be reinterpreted as a partial adjustment model. Specifically, assuming firms do indeed exhibit partial adjustment behavior, the coefficient estimate on lagged deviation in regression (3) can be interpreted as an estimate of (1-λ), where λ denotes the speed of adjustment.[9]

[9] Partial adjustment model $D_{it+1} - D_{it} = \lambda(D^* - D_{it}) + \delta_{it+1}$ is mathematically equivalent to $D_{it+1} - D^* = (1-\lambda)(D_{it} - D^*) + \delta_{it+1}$, which implies that the coefficient estimate in regression (3) can be interpreted as an estimate of (1-λ), λ being the speed of adjustment.

The concept of the speed of adjustment, however, is a very specific concept that only makes economic sense if firms behave in ways assumed by the partial adjustment model and do not deviate significantly from such behavior. Certain plausible corporate behaviors that would be broadly consistent with dynamic tradeoff models can generate "speeds of adjustment" that are void of any economic meaning. For example, consider a firm that has a target zone of leverage within which it does not, due to adjustment costs, actively adjust its capital structure. Suppose, this firm's corporate financing choices are such that it makes effort to stay within the target zone but does not try to adjust to a specific notional target level within that zone. Such a firm may, sometimes, appear to "partially adjust" towards the notional target level, but at other times, may "over-adjust" and end up on the other side of the target level, or may move away from the target level but stay within the target zone.

In Figure 7, we plot the distribution of the ratio of the change in leverage over the lagged deviation from target, with values in excess of 1 and less than -1 winsorized at 1.05 and -1.05, respectively. The distribution shows that more than 15 percent of changes in leverage "overshoot" the target (the ratio is greater than one) and that about half of changes in leverage are away from the target (the ratio is negative). With this type of firm behavior, the estimated speeds of adjustments to notional targets are not very meaningful descriptors of corporate financing behavior and can lead to false conclusions as to which firms are more concerned about keeping their leverage ratios within the zone and which are not.[10]

With the above discussion in mind, analysis of the persistence of deviations from target offers an alternative approach to testing the importance of leverage targeting with a null hypothesis that deviations from target lack any persistence at specific horizons. Failure to reject this

[10] See Hovakimian and Li (2012) for a detailed discussion of this issue.

hypothesis at horizon T does not imply that the firm is at its target debt ratio at time T, but rather implies that the existence of any deviation from target at time T is not due the firm's lack of effort to offset the initial deviation at time 0.

10. What drives the cross-sectional and the time-series variations in target leverage?

One of the enduring issues in capital structure research is that although a fairly standard set of firm characteristics has been found to affect capital structure in ways consistent with the predictions of the tradeoff theory, the importance of these factors in explaining the cross-sectional and time-series variations in leverage is limited. As Lemmon, Roberts, and Zender (2008) note "… the majority of variation in capital structure is time-invariant and … much of this variation is unaccounted for by existing empirical specifications." They further note that "…dynamic rebalancing is directed toward a largely time-invariant target, namely, the unobserved permanent component of leverage."

While DeAngelo and Roll (2015) disagree with Lemmon, Roberts, and Zender (2008) that most of the variation in capital structure is time-invariant, their findings support the concern that the existing empirical specifications are unsatisfactory and that important determinants of leverage ratios remain largely unobserved. They conclude that "… the challenge for researchers is to identify the factors that generate substantial time-series volatility in target ratios."

Although we believe that the target leverage ratios estimated in this paper do a good job in explaining both the cross-section and the dynamics of corporate leverage ratios, our results thus far do not resolve the challenges identified in these prior studies as we rely on historical rolling fixed effects to generate our time-varying targets. Indeed, if we simply regress observed leverage ratios on five-year rolling average historical leverage, the R^2 (0.638) comes very close the R^2

(0.654) from our main specification, which in addition to historical fixed effects (effectively historical average leverage), accounts for several traditional determinants of target leverage.

Such a comparison, however, may underestimate the importance of the traditional determinants. To gauge the importance of these traditional firm-specific factors, we conduct two additional tests. First, we estimate annual cross-sectional regressions of 5-year moving average leverage ratios on 5-year moving average firm characteristics. Figure 8 shows the distribution of R^2 over time, which varies between 0.07 and 0.25 and is higher in the second half of the sample period. The median R^2 in 1971-1993 period is 0.109 and the median R^2 in 1994-2015 is 0.204. These results suggest that while traditional firm characteristics do not necessarily add much explanatory power to the fixed effects in leverage regressions, they explain a non-trivial fraction of the cross-sectional variation in those fixed effects.

Second, we estimate firm-level time-series regressions of 5-year moving average leverage ratios on 5-year moving average firm characteristics. Table 19 reports the median values of the coefficients, the 95% confidence interval around the median, as well as the fractions of negative and positive coefficient estimates. The confidence intervals imply that the median coefficient estimates are negative for market-to-book and positive for tangibility and size, consistent with typical results for these variables. The median coefficient estimates for R&D and R&D dummy are zero, likely due to many firms with little time-series variation in very low levels of R&D expenses. The median coefficient estimate for selling expenses is positive, which is not consistent with our theoretical priors as discussed earlier in the paper.

Figure 9 summarizes the distribution of time-series R^2, for firms with at least 10 annual observations of moving-average variables in the time-series. The median R^2 in this subsample is 0.947. Thus, the variation in rolling 5-year firm effects in leverage over time can be almost completely explained by the variation in the moving-averages of traditional firm characteristics and is not driven by changes in some unknown unobservables. That is good news, considering the importance of this issue as underscored by Lemmon, Roberts, and Zender (2008) and DeAngelo and Roll (2015).

The bad news is that there is a lot of variation in time-series coefficient estimates across firms. As shown in Table 19, large fractions of firms generate coefficient estimates of opposite signs, which is hard to reconcile with the idea that the significance of these variables is due to their impact on target leverage ratios of all these firms.

11. Conclusions

In this paper, we investigate the dynamics of corporate leverage ratios and assess the persistence of its elements over time. We find that the estimated target debt ratios are far more persistent than the observed leverage ratios, which in turn are substantially more persistent than the estimated deviations from target leverage. The deviations from target are almost completely offset within three years with any remaining deviations being economically trivial. Positive deviations are more persistent than negative ones, implying that leverage deficit is less costly than excessive leverage or that the costs of increasing leverage are lower than the costs of reducing leverage. Larger deviations are offset faster, consistent with the predictions of dynamic tradeoff models.

We further find that the deviations are more persistent for larger firms, older firms, more diversified firms, and firms with higher credit ratings. These patterns imply that adjustments are less likely for firms with lower costs of deviating from their targets.

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Figure 1. Target leverage estimation

The figure presents the timing convention for OLS regressions of leverage on a set of firm characteristics, to estimate target leverage ratios. Time-varying target leverage ratios in year (t) are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1), estimated over the previous five years (t-1) through (t-5). The sample firms are from Compustat. Leverage targets are estimated for years 1971 to 2015. The first estimation period starts in 1966.

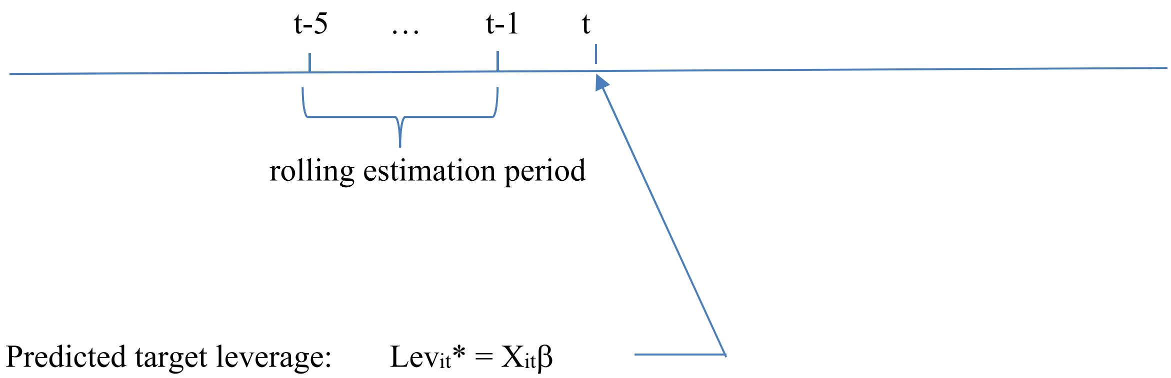


Figure 2. Histogram of deviations from target leverage

The figure presents the distribution of deviations from estimated target leverage. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1), estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. The sample firms are from Compustat. Leverage targets and deviations from targets are estimated for years 1971 to 2015.

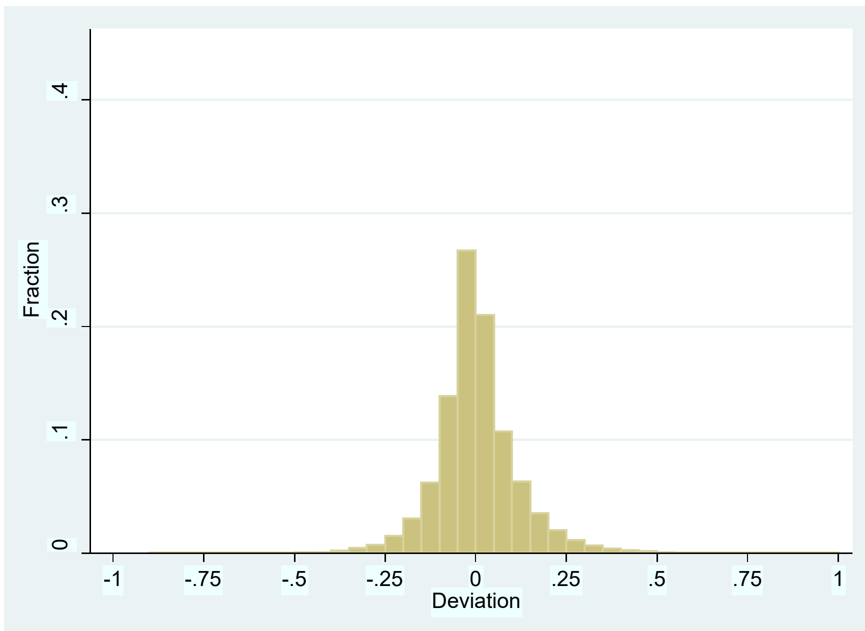


Figure 3. Portfolios of average book leverage ratios and average deviations from book leverage targets in event time

Figure 3A presents the average leverage and Figure 3B presents the average deviation from estimated target leverage for four portfolios in event time. Year zero is the portfolio formation year. Portfolio compositions are held constant, besides firms that dropped out, for ten years. Leverage and deviation portfolios are formed independently of each other, based on the quartiles of their respective distributions in the year of portfolio formation. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. The sample firms are from Compustat and the sample period spans from 1971 to 2015.

Figure 3A. Evolution of book leverage portfolios in event time

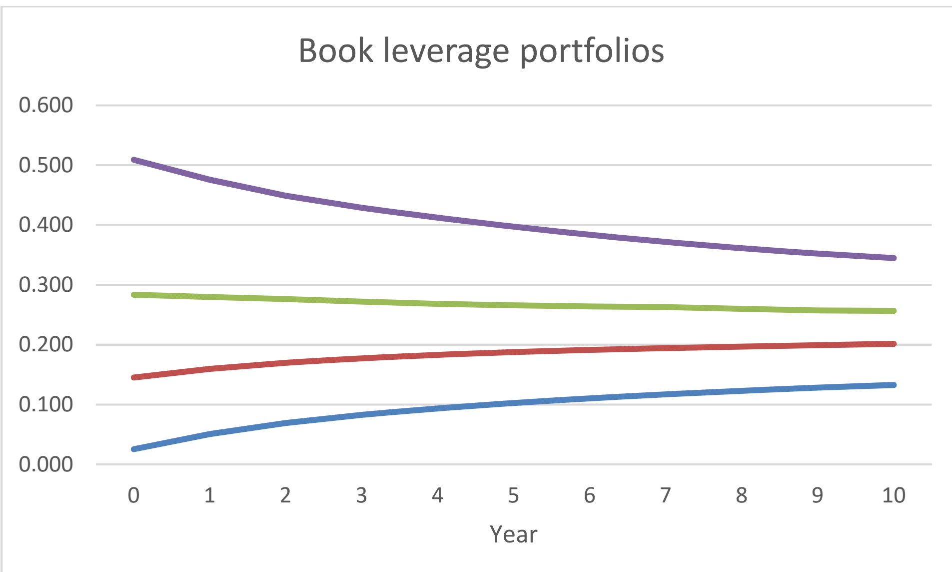


Figure 3B. Evolution of book leverage deviations portfolios in event time

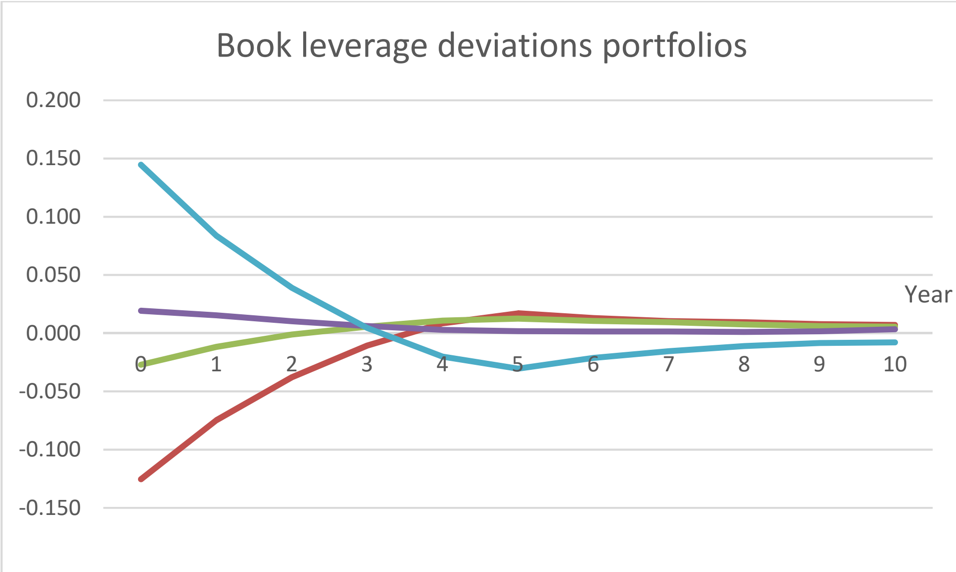


Figure 4. Stability in the cross-sections of leverage and deviation from target leverage

The Figure summarizes the R^2's from regressions of leverage ratios in year *t* on leverage ratios in year *t-n* and from regressions of deviations from target leverage ratios in year *t* on deviations from targets in year *t-n*. The horizontal axis presents the number of years between the current level of leverage or deviation and the respective lag. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. The sample firms are from Compustat and the sample period spans from 1971 to 2015.

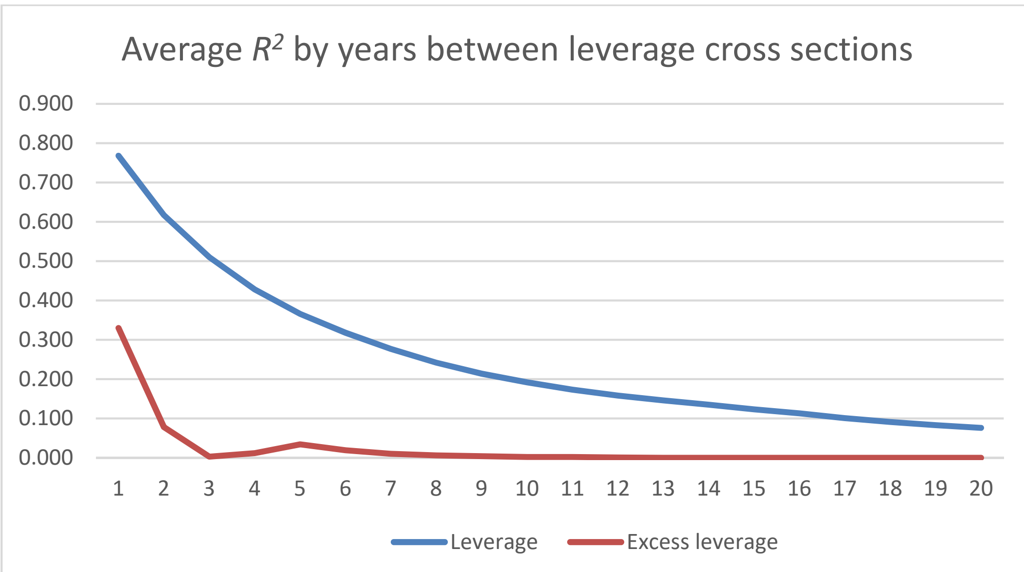


Figure 5. Distribution of deviations from target leverage: Highly under-levered firms

The figures present the distributions of deviations from target leverage ratios in years 0 (Figure 5A), +1 (Figure 5B), and +2 (Figure 5C) for firms with large negative deviations in year 0. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. A deviation from the target is defined as large negative (highly under-levered cases) if it is one sample standard deviation or more below zero. The sample firms are from Compustat and the sample period spans from 1971 to 2015.

A. Year 0 B. Year +1 C. Year +2

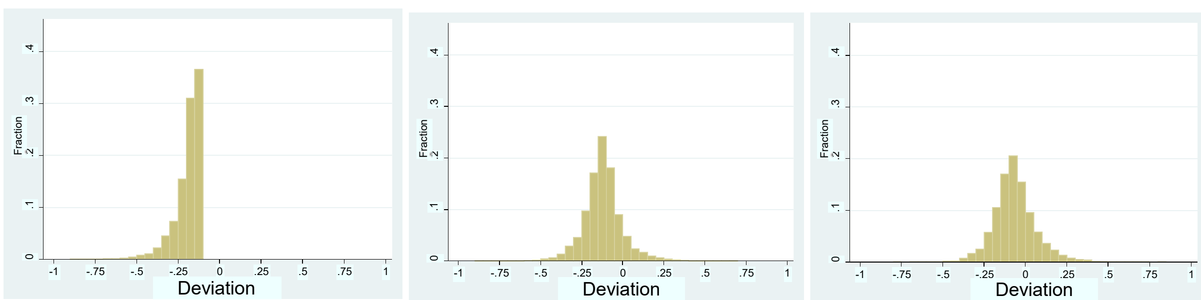
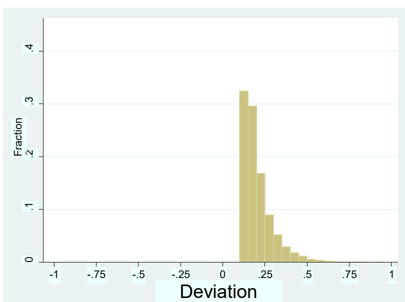


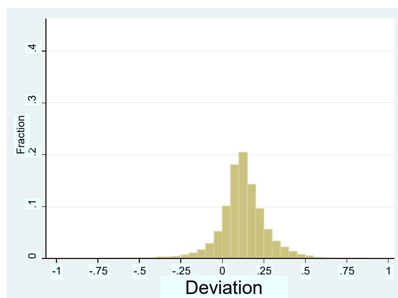
Figure 6. Distribution of deviations from target leverage: Highly over-levered firms

The figures present the distributions of deviations from target leverage ratios in years 0 (Figure 6A), +1 (Figure 6B), and +2 (Figure 6C) for firms with large positive deviations in year 0. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. A deviation from the target is defined as large positive (highly over-levered cases) if it is one sample standard deviation or more above zero. The sample firms are from Compustat and the sample period spans from 1971 to 2015.

A. Year 0



B. Year +1



C. Year +2

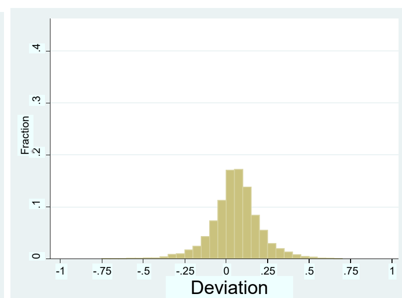


Figure 7. Distribution of ratio of change in leverage over lagged deviation from target

The figure presents the distribution of ratios of change in leverage over lagged deviation. Ratios of change in leverage over lagged deviation that have values in excess of 1 and less than -1 are winsorized at 1.05 and -1.05, respectively. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. The sample firms are from Compustat and the sample period spans from 1971 to 2015.

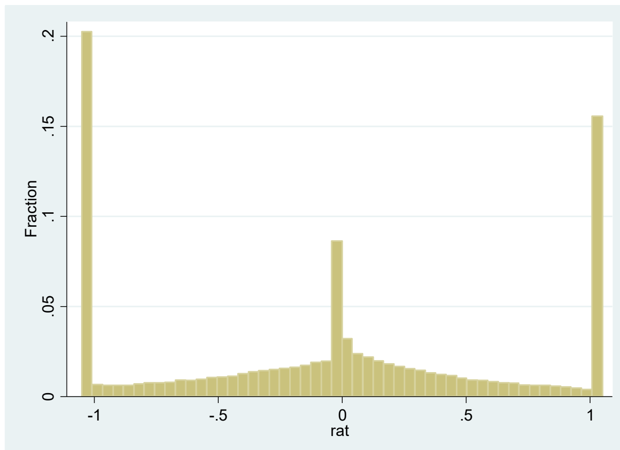


Figure 8. Cross-sectional determinants of 5-year moving average leverage

The Figure presents the distribution of the R^2 of annual cross-sectional OLS regressions of five-year moving average leverage on five-year moving average firm characteristics represented in regression (1). The first regression is estimated for year 1971 and the last one is estimated for year 2015. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above.

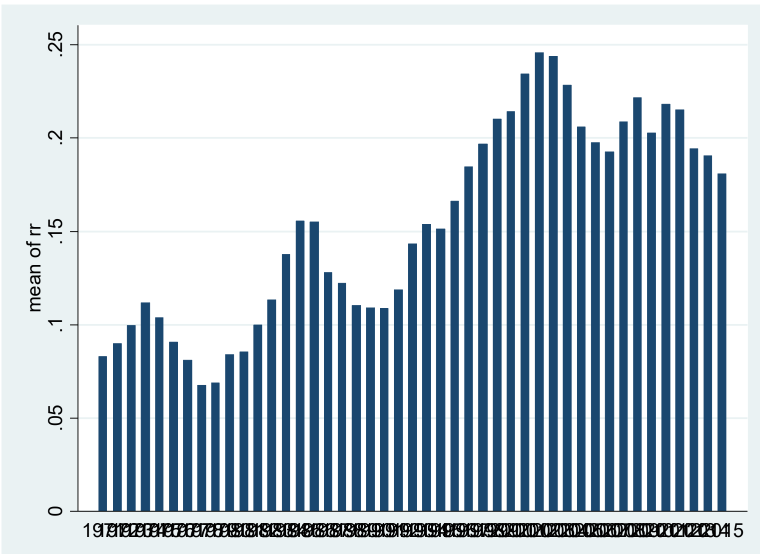


Figure 9. Distribution of R^2 in firm-level time-series regressions of moving average book leverage on moving average firm characteristics.

The Figure presents the distribution of the R^2 of firm-level time-series OLS regressions of rolling five-year moving average leverage on five-year moving average firm characteristics represented in regression (1). Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. The sample firms are from Compustat and the sample period spans from 1971 to 2015. Only firms with at least ten annual observations in the time-series are used.

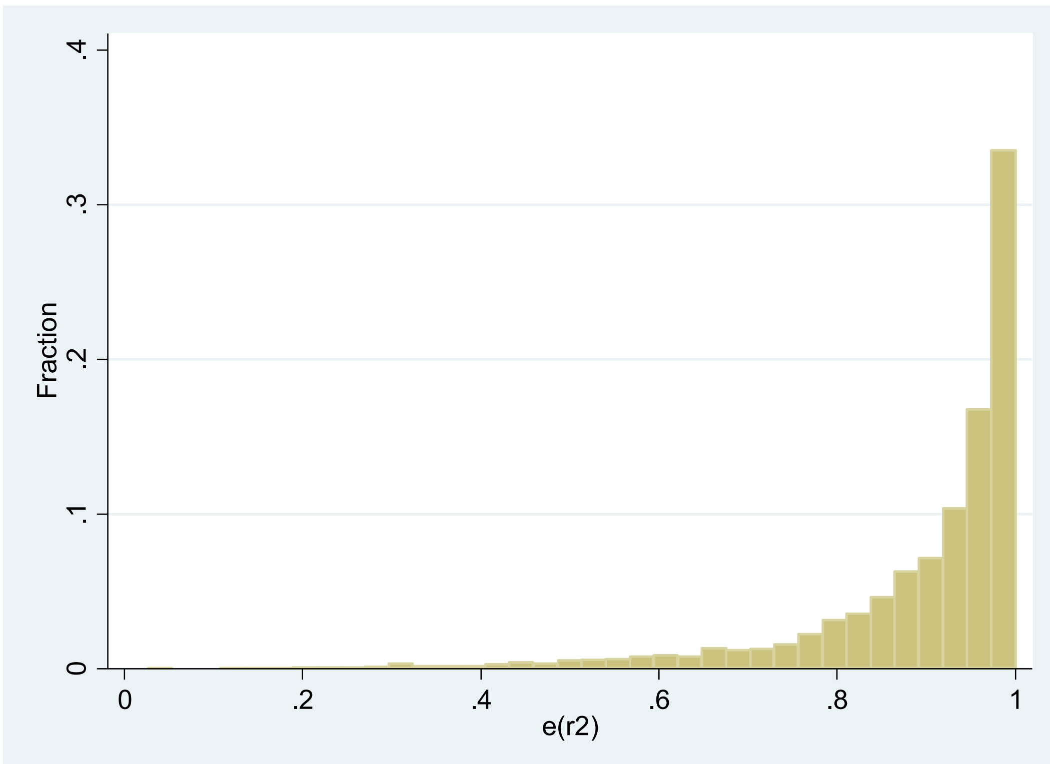


Table 1

Descriptive statistics of target leverage determinants

The sample firms are from Compustat and the sample period spans from 1971 to 2015. Leverage ratio is the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Market-to-book is the ratio of market value of equity and book value of debt over the book value of assets. Tangibility is the proportion of fixed assets in total assets. R&D is the ratio of R&D expense over sales. R&D indicator equals one if a missing value of R&D expense has been set to zero. Selling expenses is scaled by sales. Size is the natural logarithm of CPI-adjusted sales.

Firm Characteristics	Mean	Median	Std. Dev.	Observations
Leverage	0.241	0.219	0.197	125,536
Market-to-book	1.541	1.225	1.020	125,536
Tangibility	0.295	0.248	0.212	125,536
R&D	0.033	0.000	0.077	125,536
R&D Indicator	0.664	1.000	0.472	125,536
Selling expenses	0.263	0.215	0.203	125,536
Size	4.877	1.981	1.981	125,536

Table 2

Descriptive statistics for observed leverage, estimated targets, and deviations from targets

The sample firms are from Compustat and the sample period spans from 1971 to 2015. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from the rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage.

	Mean	Median	Std. Dev.	Min	Max	Obs.
Leverage	0.241	0.219	0.197	0.000	1.000	125,536
Target leverage	0.238	0.219	0.175	0.000	1.000	125,536
Deviation from target leverage	0.003	-0.005	0.117	-0.899	0.989	125,536

Table 3

Persistence of deviations from target leverage

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	(1)		(2)		(3)	
	Coefficient	*t*-stat	Coefficient	*t*-stat	Coefficient	*t*-stat
Deviation (t-1)	0.600**	157.6				
Deviation (t-2)			0.297**	64.3		
Deviation (t-3)					0.058**	10.8
Intercept	0.003**	11.8	0.003**	7.5	0.002**	3.5
R^2	0.330		0.078		0.003	
Observations	112,281		100,731		91,210	

Table 4

Persistence of leverage ratios

The table presents the coefficients of OLS regressions of leverage ratios on their lagged values. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.
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	(1)		(2)		(3)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Leverage(t-1)	0.897**	440.1				
Leverage(t-2)			0.812**	236.8		
Leverage(t-3)					0.740**	159.5
Intercept	0.028**	55.0	0.048**	56.3	0.064**	55.2
R^2	0.768		0.617		0.510	
Observations	112,281		100,731		91,210	

Table 5

Persistence of target leverage

The table presents the coefficients of OLS regressions of estimated target leverage on its lagged values. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	(1)		(2)		(3)		(4)		(5)	
	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Target leverage (t-1)	0.975**	1133.6								
Target leverage (t-2)			0.933**	512.2						
Target leverage (t-3)					0.879**	303.2				
Target leverage (t-4)							0.818**	199.8		
Target leverage (t-5)									0.754**	141.4
Intercept	0.006**	31.5	0.016**	36.7	0.027**	39.0	0.041**	40.1	0.054**	40.4
R^2	0.952		0.872		0.776		0.670		0.568	
Observations	112,281		100,731		91,210		82,983		75,601	

Table 6

Regressions of leverage on estimated targets

The table presents the coefficients of OLS regressions of leverage ratios on alternative estimates of leverage targets. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Rolling time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Full-sample target is estimated as the fitted value of fixed firm effects regression (1) estimated on the full sample. Initial time-invariant target leverage is the firm's first non-missing value of the time-varying target leverage in its time-series. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

Panel A: All observations

	Rolling time-varying fixed firm effects target		Full sample fixed firm effects		Initial time-invariant fixed firm effects target	
	(1)		(2)		(3)	
	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Target leverage	0.911**	331.7	1.000		0.585**	64.0
Intercept	0.024**	36.5	0.000		0.101**	44.3
R^2	0.654		0.659		0.280	
Observations	125,536		125,536		125,536	

Panel B: 20-year survivors only

	Rolling time-varying fixed firm effects target		Full sample fixed firm effects		Initial time-invariant fixed firm effects target	
	(1)		(2)		(3)	
	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Target leverage	0.892**	217.2	1.000		0.414**	24.1
Intercept	0.022**	23.2	0.000		0.127**	28.5
R^2	0.654		0.507		0.151	
Observations	52,999		52,999		52,999	

Table 7

Persistence in deviations from initial target leverage

The table presents the coefficients of OLS regressions of deviations from initial time-invariant target leverage ratios on the lagged values of these deviations. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Initial time-invariant target leverage is the firm's first non-missing value of the time-varying target leverage in its time-series. Deviations from targets are calculated as the difference between observed leverage and the initial time-invariant target leverage. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	(1)		(2)		(3)	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Deviation (t-1)	0.914**	370.7				
Deviation (t-2)			0.846**	200.3		
Deviation (t-3)					0.790**	136.5
Intercept	0.003**	10.6	0.004**	7.0	0.002**	4.0
R^2	0.746		0.596		0.495	
Observations	112,281		100,731		91,210	

Table 8

Falsification tests of deviation from target persistence

The table presents the coefficients of OLS regressions of deviations from simulated (false) target leverage ratios. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Simulated targets are obtained by randomly reassigning the estimated targets to other firms in the sample that have leverage observations over the same time period. Deviations from simulated targets are obtained by subtracting simulated targets from observed leverage ratios. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	(1)		(2)		(3)	
	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Deviation(t-1)	0.929**	634.3				
Deviation (t-2)			0.861**	327.1		
Deviation (t-3)					0.795**	212.4
Intercept	0.003**	8.8	0.004**	6.4	0.004**	4.5
R^2	0.841		0.715		0.609	
Observations	112,281		100,731		91,210	

Table 9

Persistence of negative vs. positive deviations from the target

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Negative deviation indicator is set to one when the deviation from target is negative and is set to zero otherwise. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	(1)		(2)		(3)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.562**	43.7				
Deviation (t-1) x Negative	0.079**	5.3				
Deviation (t-2)			0.093**	9.9		
Deviation (t-2) x Negative			0.067**	5.6		
Deviation (t-3)					-0.056**	-5.5
Deviation (t-3) x Negative					0.002	0.2
Negative deviation indicator	0.000	0.5	0.081**	46.6	0.096**	52.4
Intercept	0.006**	3.9	0.050**	20.3	0.056**	21.4
R^2	0.330		0.176		0.168	
Observations	112,281		100,731		90,578	

Table 10

Persistence of large deviations from the target

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. A deviation from the target is defined as large positive (highly over-levered) or large negative (highly under-levered) if it is one sample standard deviation above or below zero, respectively. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	Highly Under-levered Firms						Highly Over-levered Firms					
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.573**	27.3					0.484**	26.1				
Deviation (t-2)			0.015	1.4					-0.028**	-2.7		
Deviation (t-3)					-0.079**	-8.1					-0.088**	-8.1
Intercept	-0.010**	-2.5	-0.120**	-65.6	-0.119**	-73.1	0.025**	7.0	0.129**	77.7	0.130**	83.5
R^2	0.146		0.000		0.009		0.088		0.001		0.007	
Observations	11,139		9,976		9,586		12,718		11,233		9,885	

Table 11

Time-series of deviations from target around large deviations (T=0)

The table presents the time-series of mean deviations from target leverage ratios 3 years before and 3 years after a large positive or negative deviation is observed in year 0. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. A deviation from the target is defined as large positive (over-levered) or large negative (underlevered) if it is one sample standard deviation above or below zero, respectively. The second row in each panel shows the mean difference between the deviations in year t and year 0. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

Panel A: Large negative deviation at T=0

	Year						
	-3	-2	-1	0	1	2	3
Deviation from target (*Dev_t*)	-0.005	-0.057**	-0.117**	-0.195**	-0.121**	-0.064**	-0.021
$Dev_t – Dev_0$	0.186**	0.134**	0.076**	0.000	0.073**	0.128**	0.172**

Panel B: Large positive deviation at T=0

	Year						
	-3	-2	-1	0	1	2	3
Deviation from target (*Dev_t*)	0.013	0.052**	0.115**	0.213**	0.123**	0.057**	0.004
$Dev_t – Dev_0$	-0.199**	-0.159**	-0.097**	0.000	-0.080**	-0.143**	-0.194**

Table 12

Corporate financing activity across portfolios sorted on deviation from target leverage

We sort sample observations into quartiles based on the values of deviations from target leverage and report deviations from target and the likelihoods of corporate financing activities next year. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Equity issuance is defined as the instances when net equity issued exceeds five percent of pre-issue book value of assets. Equity repurchase is defined as the instances when net equity issued is less than negative five percent of pre-event book value of assets. Debt issuance is defined as instances when changes in the sum of short- and long-term debt exceed five percent of pre-issue book value of assets. Debt retirement is defined as instances when changes in the sum of short- and long-term debt are less than negative five percent of pre-event book value of assets. The sample firms are from Compustat and the sample period spans from 1971 to 2015.

Quartile	Deviation from target (t)	Deviation from target (t+1)	Equity Issuance (t+1)	Equity Repurchase (t+1)	Debt Issuance (t+1)	Debt retirement (t+1)
1	-0.125	-0.076	0.078	0.060	0.296	0.127
2	-0.027	-0.011	0.061	0.066	0.228	0.093
3	0.018	0.015	0.070	0.058	0.222	0.141
4	0.139	0.086	0.104	0.035	0.246	0.298

Table 13

Persistence of deviations from target by financing status

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values estimated separately for over- and under-levered firms in years with and without any financing transactions. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Over-levered firms are defined as those with positive deviations from the target and under-levered firms are defined as those with negative deviations. Financing transactions are equity issues and repurchases and debt issues and retirements. Equity issues are defined as the instances when net equity issued exceeds five percent of pre-issue book value of assets. Equity repurchases are defined as the instances when net equity issued is less than negative five percent of pre-event book value of assets. Debt issues are defined as instances when changes in the sum of short- and long-term debt exceed five percent of pre-issue book value of assets. Debt retirements are defined as instances when changes in the sum of short- and long-term debt are less than negative five percent of pre-event book value of assets. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	Under-levered				Over-levered			
	No financing transactions		Financing transactions		No financing transactions		Financing transactions	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.740**	173.4	0.602**	44.9	0.810**	109.8	0.519**	51.6
Intercept	-0.005**	-14.8	0.021**	18.1	-0.008**	-15.3	0.010**	9.7
R^2	0.646		0.142		0.582		0.132	
Observations	30,882		26,159		20,200		25,422	

Table 14

Persistence of deviations from target by firm size

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values estimated separately for over- and under-levered firms divided into firm size quartiles. Panel A presents the results for under-levered firms. Panel B presents the results for over-levered firms. The smallest firms are in column (1) and the largest firms are in column (4). Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Over-levered firms are defined as those with positive deviations from the target and under-levered firms are defined as those with negative deviations. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

Panel A: Persistence of deviations from target by size quartiles – under-levered firms

	Smallest						Largest	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.628**	49.5	0.650**	48.0	0.630**	34.5	0.657**	37.2
Intercept	0.007**	5.3	0.005**	3.9	0.004*	2.0	0.005*	2.1
R^2	0.231		0.224		0.207		0.218	
Observations	13,956		15,154		15,578		16,043	

Table 14 (cont'd)

Panel B: Persistence of deviations from target by size quartiles – over-levered firms

	Smallest						Largest	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.525**	25.6	0.572**	38.6	0.583**	27.0	0.578**	26.1
Intercept	0.013**	5.7	0.004*	2.2	0.003	1.6	0.005**	2.8
R^2	0.137		0.181		0.209		0.215	
Observations	10,826		11,592		12,461		13,577	

Table 15

Persistence of deviations from target by age

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values estimated separately for over- and under-levered firms divided into firm age quartiles. Panel A presents the results for under-levered firms. Panel B presents the results for over-levered firms. The youngest firms are in column (1) and the oldest firms are in column (4). Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Over-levered firms are defined as those with positive deviations from the target and under-levered firms are defined as those with negative deviations. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

Panel A: Persistence of deviations from target by age quartiles – under-levered firms

	Youngest						Oldest	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.609**	32.3	0.664**	42.5	0.674**	48.0	0.673**	57.2
Intercept	0.005*	2.5	0.003*	2.0	0.006**	4.5	0.006**	3.3
R^2	0.199		0.246		0.251		0.249	
Observations	13,567		12,884		15,760		14,175	

Table 15 (cont'd)

Panel B: Persistence of deviations from target by age quartiles – over-levered firms

	Youngest						Oldest	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.541**	27.5	0.598**	27.9	0.611**	38.9	0.597**	34.6
Intercept	0.009**	3.9	0.001	0.5	0.001	0.6	0.004	1.8
R^2	0.164		0.218		0.223		0.240	
Observations	11,209		9,673		11,403		11,803	

Table 16

Persistence of deviations from target by diversification status

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values estimated separately for over- and under-levered firms separated by their diversification status. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Over-levered firms are defined as those with positive deviations from the target and under-levered firms are defined as those with negative deviations. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

	Single-segment				Multi-segment			
	Under-levered		Over-levered		Under-levered		Over-levered	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.631**	61.0	0.527**	32.7	0.653**	58.9	0.594**	39.7
Intercept	0.005**	4.1	0.009**	5.8	0.007**	3.7	0.004*	2.4
R^2	0.227		0.150		0.217		0.217	
Observations	29,159		22,066		24,227		20,092	

Table 17

Persistence of deviations from target by credit rating

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values estimated separately for over- and under-levered firms separated into four groups based on their S&P credit rating. Panel A presents the results for under-levered firms. Panel B presents the results for over-levered firms. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Over-levered firms are defined as those with positive deviations from the target and under-levered firms are defined as those with negative deviations. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

Panel A: Persistence of deviations from target by rating – under-levered firms

	Unrated		CCC+ & lower		B's and BB's		BBB- & up	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.638**	69.2	0.291	1.9	0.736**	34.3	0.691**	35.1
Intercept	0.008**	6.1	-0.032	-1.6	0.002	0.4	0.012**	4.8
R^2	0.224		0.075		0.248		0.217	
Observations	34,694		141		4,034		4,618	

Table 17 (cont'd)

Panel B: Persistence of deviations from target by rating – over-levered firms

	Unrated (1)		CCC+ & lower (2)		B's and BB's (3)		BBB- & up (4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.543**	39.7	0.022	0.1	0.612**	28.0	0.617**	28.8
Intercept	0.009**	6.0	0.038	1.8	0.002	0.6	0.008*	2.6
R^2	0.163		0.000		0.230		0.241	
Observations	24,888		252		5,020		4,989	

Table 18

Persistence of deviations from target by business cycle and firm size

The table presents the coefficients of OLS regressions of deviations from estimated target leverage on their lagged values estimated separately for over- and under-levered firms divided by business cycle and firm size. The results are reported for the smallest and the largest firm size quartiles. Panel A presents the results for under-levered firms. Panel B presents the results for over-levered firms. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Time-varying target leverage ratios are calculated as the predicted values based on the parameter estimates obtained from rolling fixed effects regression (1) estimated over the previous five years. Deviations from targets are calculated as the difference between observed leverage and estimated target leverage. Over-levered firms are defined as those with positive deviations from the target and under-levered firms are defined as those with negative deviations. The sample firms are from Compustat and the sample period spans from 1971 to 2015. The t-statistics reflect standard errors adjusted for heteroscedastisity and firm-level clustering. Values significantly different from zero at 5% and 1% levels are marked * and ** respectively.

Panel A: Persistence of deviations from target – under-levered firms

	Smallest				Largest			
	No recessions		Recession		No recessions		Recession	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.646**	42.8	0.616**	17.0	0.636**	28.3	0.672**	22.7
Intercept	0.008**	5.4	0.005	1.6	0.003	1.4	0.006	1.8
R^2	0.232		0.253		0.202		0.223	
Observations	11,362		2,958		12,627		3,162	

Table 18 (cont'd)

Panel B: Persistence of deviations from target – over-levered firms

	Smallest				Largest			
	No recessions		Recession		No recessions		Recession	
	(1)		(2)		(3)		(4)	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Deviation (t-1)	0.503**	20.5	0.589**	15.2	0.593**	29.4	0.491**	8.8
Intercept	0.013**	4.9	0.007	1.9	0.005*	2.3	0.007	1.6
R^2	0.136		0.171		0.205		0.163	
Observations	8,602		2,246		10,543		2,842	

Table 19

Firm-level time-series regressions of 5-year moving-average leverage on 5-year moving average values of firm characteristics

The table presents the summary of the coefficient estimates of firm-level time-series OLS regressions of rolling five-year moving average leverage on five-year moving average firm characteristics. Leverage ratio is calculated as the sum of short-term and long-term debt divided by the book value of assets and is restricted to the values of 0 from below and 1 from above. Market-to-book is the ratio of market value of equity and book value of debt over the book value of assets. Tangibility is the proportion of fixed assets in total assets. R&D is the ratio of R&D expense over sales. R&D indicator equals one if a missing value of R&D expense has been set to zero. Selling expenses is scaled by sales. Size is the natural logarithm of CPI-adjusted sales. The sample firms are from Compustat and the sample period spans from 1971 to 2015. Only firms with at least ten annual observations in the time-series are used.

	Median	95% Confidence Interval		Fraction negative	Fraction positive	Obs.
Market-to-book	-0.010	-0.013	-0.007	0.56	0.43	4,804
Tangibility	0.185	0.152	0.218	0.41	0.58	4,804
Size	0.007	0.002	0.012	0.47	0.52	4,804
R&D	0	0	0	0.31	0.28	4,804
R&D Indicator	0	0	0	0.22	0.22	4,804
Selling expenses	0.097	0.054	0.147	0.45	0.54	4,804